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EASTERN SUGAR MARKETS.—The market has ruled steady and firm on the basis of 4⅝c for 96 test centrifugals. Importers' stocks are unusually light. Stocks at the United States four ports and Cuba are over 110,000 tons less than at this time last year. Refined has been advanced 10c per 100, and in good demand. The withdrawals on account of early purchasing have been large.

Stocks in Europe, 1,196,000 tons, against 1,239,000 tons last week, and 1,326,449 tons last year. Total stocks of Europe and America, 1,413,556 tons, against 1,488,711 tons last week, and 1,682,712 tons last year at the same uneven dates and 1,662,612 tons, at even date of June 1st last year. The deficiency of stock is 269,146 tons, against a deficiency of 206,557 tons last week, and an excess of 56,025 tons December 28th, 1899. European markets have risen to 11s. for beet sugars, against 10s. 9¾d. last week, caused by American buying. These purchases are said to amount to 20,000 to 25,000 tons thus far on this movement, making a total of about 90,000 tons since the first of June. Prices in Europe have advanced beyond the views of American refiners and they are now disposed to hold off.

The New York Sugar Refining Company (Doscher) together with Mollenhauer and the National Refineries, have formed a new corporation under the name of the National Sugar Refining Company of New Jersey, with a capital of $10,000,000 preferred stock and not exceeding $10,000,000 common stock, the amount of common stock not yet being fully decided. The new corporation will have seven directors, four of whom will represent the Howell interest and three the other interests. The corporation will undoubtedly be run in harmony with the American Refining Company, although this is not definitely stated. This arrangement leaves the Arbuckle Refinery still independent, as also the McCahan of Philadelphia and the Revere of Boston, but virtually establishes same conditions

between the principal refiners as existed before the building of the independent refineries.

The refiners refuse to sell for all future delivery. They are oversold ten days in consequence of the rush of orders received during the past week. The country is quite bare of supplies for this time of the year, so that the demand will likely continue large throughout the season. It will not be advisable to anticipate wants. The Mollenhauer refinery will start up again in a few days.—Willett & Gray's Sugar Statistical.

COFFEE.—The outlook is for a continuance of low-priced coffee. The great crops in Brazil and its immense possibilities as a producer, together with the expansion of coffee-growing in Mexico, Central America, and other points, insures cheap coffee, until there is some marked falling off in supply due to some crop disaster.—Am. Grocer.

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DR. MAXWELL'S APPOINTMENT.

[Commenting on the appointment of Dr. Maxwell to the service of the Queensland Government, the Mackay Sugar Journal has the following editorial comments in its issue of May.]

Despite the fact that there is a running fire of criticism concerning some of the views expressed by Dr. Maxwell in his report upon the Queensland sugar industry, more especially in connection with our method of manufacture, we doubt if any considerable number of people will regret that he has accepted the offer of an appointment in this colony. We can say without fear of contradiction that the great majority of those growing cane or manufacturing sugar in this colony will hail the news with delight. It is all very well for a few to endeavor to make us believe that we have equal talent in the colony. We are not prepared to say that we have not some very excellent men, and we owe to them such progress as we have made, but it is quite another thing to ask us to believe that their best efforts cannot be made better by a man of Dr. Maxwell's attainments. But apart from this we look to Dr. Maxwell to introduce a new era into sugar production in this colony. If others are as good as he is, others do not place their knowledge freely at the disposal of the cane farmer and the sugar manufacturer. Dr. Maxwell we hope will lift the veil from the various mysteries which still puzzle the farmer and the mill manager. We shall have at last an opportunity

of receiving light on many points which have for so long been shrouded in darkness. The farmer will learn what is the relative value of his canes, from the agricultural and manufacturing standpoint. This is a question that for a long time has seriously agitated the minds of the grower, who finds himself bound down to grow certain canes, when of the opinion that other canes would give him better weights per acre, simply because the mill says that the one is a good sugar producer and the other is not. This information may be perfectly correct, but the farmer will certainly feel happier when he has it in black and white from the departmental expert. The manufacturer on the other hand, who is struggling to secure efficient chemical control of his works, will at last be able to know definitely and conclusively whether his chemist is giving him value for his money. More than one mill we know in Queensland has almost abandoned chemical control because they have fallen victims to the wiles of bogus or incompetent chemists. The above instances are but two of many in which the farmer and the manufacturer will benefit by the rending of the veil of secrecy which still hides many of the matters connected with the sugar industry. These are really only minor ways in which Dr. Maxwell will be able to assist us, but they are important. The day for secrets is past. It was past many years ago, and for a time at least it appeared as if the light of common sense was going to shed its rays on all the operations of the industry. But gradually the disappearance of planters and millowners, and the appearance of numerous farmers, owning their own mills, scattered the small congeries that were beginning to exchange ideas and experiences, and nothing of equal benefit has been created by the new proprietors of the farms and mills. Thus secrecy again began to hide the operations, though certainly in no way to the same extent as it did twenty years ago. With the advent of Dr. Maxwell we may expect to speedily be put in possession of all the important facts connected with the industry, and also to keep up to date in the new and profitable improvements that may be made in other parts of the world in growing of cane, or converting its contents into sugar.

The question of the payment of Dr. Maxwell is one which cannot well be avoided, while touching upon this subject. That he will receive a salary proportionate to his abilities goes without saying, and the sugar industry will have to pay the money. In addition there will be inevitable expenses for

experiment stations, which at first cannot hope to be self-supporting. These expenses will, of course, be partly borne by the Government, just as similar expenses for stations and model farms in other places are met out of general revenue. But the sugar industry is asking for rather more than other industries, and those engaged in sugar will have to contribute in consequence. That this is regarded as only reasonable we have proof in the resolution recently carried by the conference of sugar producers held in Mackay. The only question at issue would appear to be whether the tax is to be levied on cane or on sugar. If we levy the tax on cane, the expenses of collection will be heavy, while the payment of the taxes will be to say the least perfunctory. If, however, the tax is levied on sugar, there will be little or no expense in the collection, while the millowners, often the farmers themselves, will have no difficulty in adjusting the amounts to be paid on a fair basis between the farmers as cane growers, and the farmers as cane buyers. We have heard it argued that the mills should pay nothing because they would not benefit by having Dr. Maxwell in the colony, but this contention will not hold water for a moment. It is first of all based on the probable fallacy that the mill managers of the colony have nothing to gain that Dr. Maxwell could teach, secondly on the certain fallacy that the mills will not benefit by having organized and efficient chemical control, and lastly on the greatest fallacy of all, namely that the mills will not benefit, if the farmers grow heavier crops, supply more cane, and cease to be a burden, as they often are, upon the finances of the mills themselves. The central mill companies have in many cases found it necessary to make very considerable advances to the farmers, and it is the height of folly to pretend that it would injure the mills to make money lending an unnecessary part of their business. We think the tax to be levied by Parliament should be placed upon the sugar, leaving the farmers and mills to subsequently adjust the further distribution of the burden. One thing is certain: So great will be the benefit, that the burden of payment will become a mere bagatelle. The Government has acted wisely in so promptly securing Dr. Maxwell's services, and it will ill become the sugar people to haggle as to how and when an industry, producing over £1,000,000 worth of sugar in a year, is to find the expenses of his salary, and the necessary equipment to make his work successful.

DR. MAXWELL, SUGAR EXPERT.

The appointment of an officer skilled in sugar matters is to be commended. When it is remembered that there are 110,657 acres devoted to the growth of sugar cane in the colony, that 123,000 tons of sugar are produced annually, that there are 58 sugar mills, 10 crushing mills, and 3 refineries in the colony, and that the Government is interested to the extent of £549,442, owing to the advances under the Sugar Works Guarantee Act to the 13 Central mills and one Tramway Company, it is surprising that such an officer has not been appointed before. Its importance exceeds that of any other agricultural industry, and yet it has been the last to receive necessary help and advice. How much this aid was required the newly appointed expert, Dr. Maxwell, has in his able report fully laid before the country, and the appointment of this enthusiast to the position of Director of Sugar Experiment Stations will receive the warmest support of all friends of the sugar industry. A question which awaits settlement is that of the payment of the salary of this gentleman and the number of experimental stations necessary to carry out the work therein in a proper manner. The sum of £3,000 per annum and expenses is the amount stated unofficially as the remuneration for Dr. Maxwell's services, and that four stations will be established. The sugar growers have stated their willingness to bear a portion of the expense, which shows their concern. We have every confidence that the action of the Minister for Agriculture (the Hon. J. V. Chataway) will bring a thorough revival throughout the sugar centres. As things are the sugar industry is losing vitality, and unless the advice of Dr. Maxwell is taken up and turned into practice our plantations will dwindle, and the money sunk in the machinery of the mills will be in serious jeopardy. That the doctor's services to Honolulu have been of immense value is shown by the independent testimony of Mr. Kidd, the special representative of the C. S. R. Co., who visited Honolulu to find out the facts of the matter, and came away astounded at the result. As our contemporary, the "Cairns Daily Argus," well puts it, "the reports are nothing to the wondrous realities! He has seen cane more like forest trees than the slender stems of the old familiar saccharine plant. He has seen them taking 13.7 tons of sugar off the acre. Dr. Maxwell himself reports that Mr. Kidd was much taken with his cane fields that yielded 120 tons per acre. Can the same results be reached here? Mr.

Kidd fears not. We have not the climate. Not everywhere we know; but up Mossman way there should be enough rain, and in some other places irrigation may be feasible. Let us not despair of getting 120 tons to the acre." It is to be hoped that Parliament will deal with any proposals that may be laid before it to assure the full success of Dr. Maxwell's experiments in a liberal spirit, so as to ensure a thorough reform.—Queensland Country Life.

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AROUND HAWAII.

Half the pleasure of an inter-island vacation trip consists in having good weather and a smooth sea, with just breeze enough to keep passengers in cheerful humor from start to finish. Such was our good fortune, as we left Honolulu harbor in June to make the circuit of Hawaii by sea and land. A swift four hours' run brought the Kau packet abreast the west end of Molokai, where the evergreen groves of Kiawe or Algaroba trees line the shore for miles in extent, dropping daily abundant supplies of succulent pods that serve as rich food for domestic animals which are attracted to them from the highlands. These are known elsewhere as the Carob or St. John's trees, and the fruit or pods are what the apostle is supposed to have lived on while in the desert of Arabia, of which it is a native plant. The seeds were brought to these islands from Valparaiso, some sixty years ago, by the late Bishop Maigret, and from them was raised the first tree grown here, still standing in the north corner of the Catholic church yard in this city—a living monument sacred to his memory. Algeroba groves are now found growing on each of the islands of this group, mostly on the lee or sheltered sides, as the salt spray and air blown by the strong trades prevents their growth on the windward shores.

As our steamer glides rapidly along, there may be seen on the plateau above the village of Kaunakakai a field of sugar cane, some six hundred acres in extent, apparently as green and thrifty as any cane growing in other localities. It is some six or seven months old, and as viewed from the deck of the steamer appears in good condition, kept so apparently by the light sun showers that daily give it a few sprinklings, and by the deep rich soil on which it is planted. Yet the absence of reliable rains and mountain springs and streams, so far as is known at present, creates conditions of risk, from which timid capital shrinks. Still, as it rains frequently on the eastern

half of this island, the time may come when this abundant rainfall may be captured and conveyed forty or fifty miles with profit to its western half for agricultural purposes, instead of emptying into the sea, as at present. Stranger things have happened in other countries, and it may yet be found a matter only of dollars and cents, backed by Yankee pluck, to secure this wasting flood, and turning what is now a total loss, into a permanent and abundant supply for irrigation on this desert tract.

Reaching Lahaina after a short stop of thirty minutes, nothing worth noting is seen in this ancient and now dilapidated capital of the group, except that it has become an extensive sugar plantation, with canefields stretching for miles along the shore from Kaanapali to Olowalu. The steamers that pass Lahaina stop only to leave or take off the few passengers and freight awaiting transportation. The same may be said of the landings of Maalaea, Kihei and Makena, between east and west Maui. Our steam packet then glides on swiftly and in smooth water around the lofty mountain of Haleakala, the ancient "House of the Sun," running closely along the coal-black lava shores, the sea abreast of which is almost unfathomable, except with a deep sea line.

At daybreak the good steamer is close under the shadow of the extinct crater of Mount Haleakala, and a little later drops her anchor in the placid bay of Kailua, where she remains several hours discharging or taking on freight. This place as well as the entire district, as far as the south point of Hawaii, has at present very few attractions for tourists. On the mountain slopes, back of Kailua may be seen the ever green cane fields of the Kona Sugar Company, which is this season harvesting its first crop, about five hundred tons of sugar, to be increased during the next two years to four and five thousand tons annually. A few fields of coffee may be seen scattered among the green foliage on the mountain slope, but from all accounts this industry does not prosper as it might, were the price of coffee more remunerative than it is at present. So long as Brazil can raise this staple product and dispose of it in the leading markets of Europe and America at seven and eight cents a pound, there is little or no inducement to engage in its cultivation as a profitable industry in any other country.

In the early dawn of the second day out, the steamer rounds Kalae Point, the extreme southern cape of Hawaii—a locality noted for the wreckage and drift logs occasionally thrown

ashore, and which often line the beach for miles, consisting mostly of timber and trunks of trees and occasionally wreckage of vessels. It was here that the writer visited the spot and sketched one of the masts of the United States sloop-of-war Levant, which was lost in the winter of 1860, while on the passage from Hilo to the mainland. After leaving Hilo the ship was never heard from. The spar that drifted ashore was the fore or main mast, and had a rack for guns still remaining on it. The dimensions of the spar were carefully measured—length, girth and a piece cut out from it for identification. This piece proved the spar to have been made of Kauri-gum timber, and as the ship was built in the United States, it was thought that it could not be the Levant's. However, the piece taken from the mast was sent to Washington by the American Minister, and on referring to the record of the Levant, it was found that she had once been to Auckland, New Zealand, and while there had a new mast put in, which was made from a Kauri-gum tree. This gave a perfect identification, and it was decided in Washington that the spar referred to as having drifted ashore at Alualu, belonged to the Levant—the only relic ever recorded from her. The full details of this incident were published at the time in the Advertiser of 1861, and again referred to in the same paper March, 1898.

Passengers from the Kau steamers land at Honoapu and Punaluu in the early morning hours, when the sea is generally smooth. It is a primative mode of landing, but when once ashore, or safely on board, the discomfort is forgotten, amid the novelty of rocky cliffs and green mountain scenery that greet the eye in every direction. The government road leads from Naalehu via Hilo to Pahala. At best all the roads in Kau are rough until the volcano house is reached. Those who are in search of volcanic scenery will find it in Kau in every form and more than abundant.

A ride over the rocky lava roads of Kau is not a novelty to any one who has lived or traveled in the district, but a ride behind the dummy engine over the newly re-constructed railway from Punaluu to Pahala was such. The track has been very much straightened and improved as compared with what it was formerly. The time may come when the steam car may traverse the entire distance from Hilo to Kau via the crater. At present the route is covered by stages, which run weekly or oftener if desired.

An accident of a somewhat rare nature occurred at the

Pahala mill the morning of our arrival. A workman was engaged in mending the flume, which was carrying cane to the mill, four miles distant. His hammer, by some accident, was caught in the cane and carried along with it in the flume, but was not missed at the time. As the cane shoots down with great rapidity, the tool was not long in reaching the mill, where it went with the cane to the ponderous shredder, which slices the cane into thin pieces, but is not warranted to do the same with cast steel hammers. On the other hand, the mischievous tool tore and crushed the teeth of the shredding machine as though they were chips of wood. Of course the mill was stopped, and its ponderous cylinder, which weighs many tons, had to be taken out, and the broken teeth removed—a heavy task, which only skilled workmen could promptly handle. Fortunately duplicate sets of the broken parts were on hand, and the men ready for the job. Within forty-eight hours, this serious break was repaired and the mill started up, as well fitted as it was before the accident. Mention is made of this to emphasize the importance of having on hand duplicate pieces of such parts of the machinery as are liable to breakage. We have never heard of a similar accident here, nor any so heavy break-down mended so quickly. In a large factory of any kind, "time is money," and it is well to be provided for any such emergency.

Pahala plantation has adopted a co-operative system of cane planting, which is worth mentioning here. About one-third of the area of cane now growing on the estate is cultivated by Chinese and Japanese, under contracts which allow them one-third of the sugar obtained from their cane. Most of this is on the high mountain land, some of it 2800 feet above the sea, and the greater part of the cane grown on these highlands is the Whitney variety, which is well adapted to that elevation where the Lahaina and other canes will not grow so well. Some may think that one-third of the crop is a large proportion to allow the growers, but it must be borne in mind that the first crop requires about three years to mature at that elevation. Clearing off the forest, plowing and cultivating there are more laborious than on the mellow lands lower down. Still the cane of the contract men turns out four, five and six tons of sugar to the acre, one-third of which goes to them. This system is becoming very popular, and though their share may be large, they certainly earn it for their three years' labor, while the two-thirds' share received by the plantation secures to the

shareholders the largest dividends obtained by any company in Hawaii, with very little outlay. All estates may not be so situated as to adopt such a profit-sharing system, yet some can do so, and it is probable that this system will be adopted by others.

It may be remembered by some old residents that Pahala was commenced in 1877 under very unfavorable circumstances—severe droughts, a poor mill, poor sugar boilers and many other drawbacks interfered with its success. Lahaina cane, which does so well on lower fields disappointed the pioneers. The scarcity of water was also a great drawback. At one time one of the principal owners thought of abandoning the field as a sugar venture. But the tide turned, and year after year gave improved results. The introduction of a new variety—the Whitney cane—originating on Pahala, which would thrive on the high lands as well as the Lahaina does on the lowlands, has had much to do with the subsequent development of the estate. For ten years past this has been the leading cane on Pahala estate, and it is still, growing in favor each year. So long as it secures returns as at present there can be no question as to Pahala standing at the head of the list of our successful sugar estates. And the co-operative plan now being adopted by the present manager will unquestionably insure to it for many years a place among the safest investments on Hawaii.

The public road from Pahala to the volcano still remains one of the worst on Hawaii, and though sporadic attempts are made to improve sections of it, every downpour of rain leaves it as it was before, almost impassable in some places. A good road between Pahala and the volcano would secure much more travel through Kau than it has at present.

Of the crater of Kilauea, little can be said. It lies in a dormant state, with abundance of smoke and steam, but no fire, unless it be a faint glimmer now and then. The fact that the present level of the lava floor in the crater around Halemaumau is fully 300 feet—perhaps 500—higher than it was in the early part of the last century, is proof that the crater of Kilauea has been raised, at least on the western half of it. The high western wall was reported by visitors in the early part of the century as 1200 feet above the lava floor. It cannot be more than half that hight now. The crater around Halemaumau has unquestionably been raised during the past fifty years, and if the three volumes of the early records of the Volcano House could be found, they would throw some light

on this point. These volumes were claimed by Mr. Benj. Pitman, and are supposed to have been taken to Boston by him, when he left Hilo about 1865.

The Volcano Hotel is under the charge of Mr. F. Waldron, and is well kept. Stages run to and from Hilo to the crater every two days, and the road being good there is considerable travel over it. The fare to or from the Volcano House and Hilo is seven dollars. Many changes have taken place among the residents of the coffee district, some having sold out to the sugar company. Small cane patches may be seen on every side, planted chiefly for seed, which is in demand in the district. The improvements of the Olaa Sugar Company are evident, and work in every direction seems to be pushed. This of course is all pioneer work, and intended only to start operations in this new and untried district.

The first section of the railroad connecting Hilo with Olaa plantation has been completed, and we were favored by the superintendent, Mr. Kluegel with a ride over it. The depot is located near the steamer wharf at Waiakea. The road is ten miles long and runs in an almost straight course through the Hilo forest belt to a temporary station, some two or three miles from the site of the sugar mill, yet to be erected. It carries all the freight for the plantation and will be fitted to take passengers also. There is destined to be considerable travel over it, when extended, as it may be, to perhaps the volcano, whenever trade and travel call for extension.

Hilo has a good hotel, well kept, but not large enough to accommodate the increasing travel of the port. Tourists can have no cause for complaint, if previous notice is given to secure rooms. It stands on the site of the old hotel, which was the same as was occupied as a dwelling by Capt. Spencer, and before him by Benj. Pitman. It is central and the best location for a hotel that Hilo affords.

The writer landed in Hilo in the fall of 1849, when Mr. Pitman was "lord of the manor," when most of the dwellings in the place were grass houses, and the population consisted almost wholly of native Hawaiians. Now very few of the latter are seen there—Chinese and Japanese having taken their places. All will be glad to learn that Hilo is soon to have a much needed post office, to be erected probably by the United States Government. The building should be large enough to accommodate the postal, customs and other branches of the federal service—all under one roof.

Hilo is a very picturesque place, with its spacious bay in the fore, its two lofty mountains in the background, and with its green cane fields stretching from "the woods" on the south to distant Kohala on the north, and from the ocean to the forest belt—a most charming picture, that cannot fade from memory, for many years after the visitor has left its Elysian bowers. H. M. W.

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MOLASSES AS STOCK FOOD.—We would call the attention of sugar planters and others who keep large numbers of horses and mules to an article in this issue entitled "The Economic Feeding of Working Horses," received from Mr. T. Hughes of Sydney, through Messrs. Alexander & Baldwin of this city. Mr. H. visited these islands some two years ago, and became acquainted with many of our engineers and managers. In a note accompanying the article he says:

"Concerning the treatise by Mr. Walton, I would emphasize the fact that the system referred to, has now been in use upon a very large scale for over three years. It may be remarked, however, that we consider it would be useless to expect stock to take up the molasses diet so long as the heavy grain and hay ration customary in the Hawaiian Islands is continued. With us it was simply a question of gradually substituting the molasses for about 30 lbs of maize—the former weekly grain ration to mules—and how successful this has been in Fiji I explained personally.

"In Queensland, however, where the pasturage is poor, the results were disappointing; and we think that the success of molasses as stock feed depends as much upon the quality and quantity of the green food given, as upon the absolute necessity of the molasses being quite fresh.

"Climatic considerations may also have some bearing upon the matter."

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SUGAR PRODUCTION IN QUEENSLAND FOR THE YEAR 1899.

From the report of the Register-General of Queensland on the sugar industry of that colony for the year 1899, we copy the following items:

The production of sugar for the year 1899 shows a very considerable decrease on that of 1898, owing principally to frost

experienced throughout the whole of the sugar districts as far North as Mourilyan, and the dry weather.

Whilst the yield of sugar for 1898 reached a total of 163,734 tons, that of 1899 is only 123,289 tons, or a decrease on the previous year's production of 40,445 tons, being 25 per cent less than the production for 1898.

The area of land under the cultivation of sugar cane and that crushed for each year is given as—

Year.	Cultivated.	Crushed.
	Acres.	Acres.
1896	83,093	66,640
1897	98,641	65,432
1898	111,012	82,391
1899	110,657	79,435

Showing a decrease for the past year in area under cultivation of 355 acres, and in area crushed of 2,956 acres.

The average yield of sugar per acre throughout the colony was, in 1897, 1.50 tons; 1898, 1.99 tons; and 1899, 1.55 tons; so that whilst the decrease in area of cane crushed equalled 3.59 per cent, the yield of sugar was 24.70 per cent, or nearly half a ton of sugar per acre below that of the previous year.

The number of tons of cane required to make one ton of sugar was 9.54 for the past year; the number required in 1898 being 9.42 tons, these averages being for the whole colony.

The reasons given by most of the cultivators for such shortage were frost, want of rain, in some cases grubs, and in many cases all three. Undoubtedly the severe frost which occurred in July is very largely the cause of the decrease, especially as it was immediately followed by rain in most districts, and the mills in some cases were not quite ready to deal with the frosted cane, which deteriorated rapidly where compelled to remain uncut for any length of time.

In view of Dr. Maxwell's report on the declining fertility of our sugar lands, it may not be out of place to draw attention to the quantity of manure produced by meat works, bone mills, etc., which in 1899 turned out about 20,000 tons, of which 9,915 tons were exported, exclusive of 23 tons of sulphate of ammonia, or, as nearly as possible, one half of the manure made in the colony was exported instead of being used here.

I am informed from official sources that the average yield of sugar from India (Bengal) is about one ton per acre, but that

owing to drought only 80 per cent of this is expected for the 1899 crop.

In several of the West Indian Islands the returns are estimated to be about one ton of sugar per acre, but in many the returns are approximate only, no exact data being obtainable.

In Java the returns are given at 39.3 tons of cane per acre, the produce of which gave three and nine-tenths tons of sugar per acre, and the quantity of cane to the ton of sugar to be ten tons. My informant further states: "The cane of the sugar estates, the product of which is intended for export, is, without single exception, planted in ground which can be irrigated."

In connection with the above report, we may add the advice given by a Queensland planter to his fellow planters:—"The greatest care should be taken in the selection of seed. The Rose Bamboo in the past seems to have been the planters' friend, and though of late years it has been liable to disease, I yet think that when the land is properly cultivated, and the soil is receiving the plant food it requires that this cane will prove the best. I am confident that with improved cultivation, intelligent use of chemical manures and irrigation, Mackay sugar lands would be again as productive as they were in the past."

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Plantation Laborers.—The promulgation of the annexation of Hawaii to the United States resulted in a movement on the part of some of the Japanese laborers on plantations to suddenly quit work, and for a while it was like a bee-hive in swarming time. However, when the new conditions were explained to them by the Japanese officials here, most of the laborers resumed work at an advance of wages satisfactory to all except the rioters, who were peremptorily discharged, and will returned to Japan. The remaining laborers claim all the special privileges which were formerly allowed to them, though not in their contracts, which they will no doubt have. They know very well that they are now liable to be discharged for cause, and will probably do better service than formerly. The Japanese officials resident here have been of great service in quieting their countrymen, making clear to them the advantages secured by remaining here. The men do not wish to return to Japan, for Hawaii is a paradise compared with their native land. There are probably between forty and fifty thousand Japanese here now, many of whom will settle down as permanent residents, owning and cultivating land, and engaging in various industries, like native Hawaiians.

PACKING SUGAR IN JAVA.

I wish to call attention to the fact that a new problem, and so far an unsolved one, is appearing in connection with the sugar trade of this colony. It is of special interest to Americans, as in the last two seasons at least seven-tenths of the sugar crop of Java went to the United States. It is the question of packing sugar.

At present, sugar is packed in cases made of matted bamboo straw, and it has been found to be the ideal packing, far superior to the grass mats used for Philippine sugar. Unfortunately, owing to improvident methods and neglect of government supervision, the bamboo is showing signs of giving out, and experts predict that the time is not far distant when it will be so scarce as to become too expensive to use in packing sugar, in view of the present small margin in the profits of sugar planting.

In some districts, there have been government officials who had foresight enough to compel the natives to plant a new tree as soon as the old one was cut down; but unfortunately such cases were few and far between, with the result that many districts of Java are now almost entirely denuded of bamboo.

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THE CONSTRUCTION OF THE VACUUM PAN.

* * * A vacuum pan is like any other piece of machinery and the construction of it must depend somewhat on what kind of a product is to be boiled in it. So if a low grade sugar, such as is made in Cuba from cane, or in Europe from beets, where low pressure steam is entirely used then any old style of a pan will do, to stew in. But if a good grade of sugar is desired, especially granulated, we want a modern pan to do it with, and then we don't want to look to any ancient writers for them to theorize. What they say sounds well, but for practical purposes they are behind the times.

The principal point in the working of a good pan is the way the coils are arranged, this being the whole secret to proper circulation. So I would set my coils not closer than eight to nine inches apart, and the spirals six inches apart, leaving a good opening of 22 inches down the center. Under no conditions must the coils come within closer distance than five inches from the sides and the further the better. All coils

should have a good pitch toward the center with taly pipes leaving the bottom.

The distance between the coils is the most important point, as the masse cuite in its ebullition rises from the coils 5 to 7 inches, and must have no impediment, otherwise circulation is prevented. No coil should travel more than 50 feet before making its exit into the tail pipe. So a coil 150 feet long would have three inlets and three outlets, and should be placed in the pan as right and left coils, so as to equally distribute the heat.

So in a ten foot pan arranged as above, there should be 750 square feet of heating surface of 4-inch coils; all tail pipes should lead to one trap having a float and pump attached, to be situated as near the pan as possible and to be connected direct with the water supply pipe of the boilers.

The charge pipe for syrup or thick liquor should enter just above the proof stick and turn down in the center to near the foot valve; the method now being adopted in the beet factories is to enter at the foot valve; this is only a cheap method the manufacturers have adopted to get out of an expensive charge valve.

Now with a pan arranged as described with 75 pounds pressure of live steam (exhaust steam on a modern pan making high grade sugar is better out in the atmosphere) the higher the pressure the better, will boil if all other conditions are correct in two and one-half hours, allowing twenty minutes to boil to grain and two hours and ten minutes to build up and harden the grain.

Mr. Fred W. Wolf seems to advocate slow boiling and refers to several famous writers. With them I do not agree. They are too ancient. I have always believed and do yet that a multiple effect and a slow boiling pan are the greatest inverters we have to contend with. My experience has taught me that the quicker we boil, and that at a good temperature, the better the sugar and the less the inversion. It is a well-known fact among old centrifugal men that a strike boiled quick will always purge better and wash with one-half the water to make white sugar.

During the past campaign I visited the Rochester Sugar Factory, Michigan, where I happened to meet one of the firm of Joseph Oat & Sons, who stated that they had or were going to take a contract to build a pan to boil a strike in one and a half hours.

All this talk of inversion by high heat, which we hear of now in the beet industry, is all a myth. There is only one chance left for inversion outside of what I have mentioned above, and that is from the liquor or syrups coming in contact with the floating germs in the atmosphere. And what kills germs? High temperature.

SUGAR BOILER,
Bay City Sugar Factory, Essexville, Mich.

THE ECONOMIC FEEDING OF WORKING HORSES.

By T. U. Walton, B. Sc., F. C. S., F. I. C. From Agricultural Gazette of N. S. Wales, Feb. 1898.

It is generally accepted principle that in order to keep a working horse in good condition a food rich in nitrogenous material must be used, or, as it is sometimes expressed, the "albumenoid ratio" must be high. This ratio is defined as the numerical relation of the digestible nitrogenous matter in the food to the digestible carbo-hydrates (including any small quantity of fat, calculated into its equivalent of carbo-hydrate, but not including any digestible fibre, which has been found to be useless for the production of work.) Thus a ratio such as 1 to 5 is said to be high, while a ratio of 1 to 2 is regarded as low.

For farm horses Wolff, the recognized German authority, recommends a daily diet containing the following quantities of nutriment per 1,000 lbs. live weight;

1.56 lb. digestible albumenoids
11.19 lb. digestible carbo-hydrates (including 0.' lb. fat).
Albumenoid ratio 1 : 7.

When horses are very hard worked he recommends an increased diet still richer in nitrogen:

2.5 lb. digestible albumenoids
13.8 lb. digestible carbo-hydrates.
Albumenoid ratio 1 : 5½.

The object of the present paper is to give a short account of some feeding trials conducted on a very large scale, which prove that at least under certain conditions a high diet is not essential to the performance of hard work or the maintenance of good condition provided sufficient nutritive food be given.

In Fiji the Colonial Sugar Refining Company have about 1,000 head of farm horses which, until a few years ago, were fed chiefly on oats and maize, with some green cane tops in addition. But this did not prove satisfactory in the trying tropical climate; sickness was frequent, and the death-rate high, while the charge for fodder was very heavy. As large quantities of waste molasses were available, it was thought well to investigate whether the sugar in this material might not be advantageously used as a substitute for some of the starch in the ordinary food.

The use of beet molasses for feeding dairy cattle and for fattening stock has in certain parts of Europe proved highly satisfactory, but I have seen no record of its use in the regular diet of working horses. Cane molasses contains much less nitrogen than beet molasses, the Fiji article having only one-fifth of what is usually present in the beet product, and being, therefore, according to the generally accepted theory, less valuable for feeding purposes.

When these trials were commenced care was taken to begin

with only small quantities of the new fodder least the high proportion of salts should prove too laxative. Horses unaccustomed to sugar do not like it at first, but the sweet taste is soon acquired, after which they will eat it in preference to any other food. With the growing appetite for it the proportion of molasses was gradually increased till as much as 30 lbs. per day were regularly given to many of the animals. This large proportion was after a time, however, reduced to 15 lbs.; not by reason of any ill effect beyond a tendency to fatten, but because it was considered too risky an experiment with so much valuable stock. Contrary to expectation, the molasses diet produced constipation, instead of being laxative, and a few pounds of bran had to be given daily to keep the bowels in order. The ration finally adopted was 15 lb. molasses, 3 lb. of bran, and 4 lb. of maize per day, with as much green cane tops as the animals can eat, the molasses being mixed with the bran and chopped cane tops. It may be mentioned that on one occasion when the supply of maize ran out, and had to be replaced by some additional molasses and cane tops, the absence of it for a month or two did not seem to affect in the least the health or working power of the horses. It has not yet, however, been decided to discontinue altogether the use of maize, and the ration referred to (15 lb. molasses, 3 bran, and 4 maize) has now been given daily to the whole stock of over 400 horses at Rarawai Plantation for nearly two years. The result is entirely satisfactory. There has been no undue fattening nor injury to the wind, and no tendency to excessive perspiration or softness. In the early stages of the trial, a dozen of the animals were weighed once a month, the average weight at the start being 1,273 lb. After the first month there was an average loss of weight of 15 lb. per head, after the second month 4½ lb. of the loss had been recovered, and after the third month there was a further gain of 16½ lb., making a gain over the whole period of 6 lb. per head.

Sickness, which formerly was frequent, is now uncommon, and the horses are capable of performing harder and more continuous work. The improvement in this respect is so great that while the area of cultivation has been largely increased, it has not been necessary to make any addition to the working stock.

Another important consideration is the financial result. In 1893, with oats as the staple food, it cost £13 3s. per head per annum to feed the stock; in 1897 this has been reduced to £4 2s. 2d. (about 40s. per head, being a saving of over £9 per head per annum. Such a saving, however, has only been possible by reason of large quantities of waste molasses and valueless cane crops being available on the spot. Cane tops cannot in ordinary circumstances be procured for horse feed by the farmer, though lucerne or any fresh grass is even more suitable. Then, for molasses, which at a sugar-mill has little or no value, a price has elsewhere to be paid to cover the cost of

carriage and handling. But this is not all, for the customs tariff makes the use of molasses for feeding purposes almost prohibitive in all the Australasian Colonies in which it is not produced. In Queensland and New South Wales, with production of molasses beyond the demand for it, the tariff is inoperative, the selling price being actually lower than the duty itself. Yet, even in the Colonies where duty is charged, it is a question whether it would not pay to use a certain proportion of molasses, containing as it does more digestible matter than oats,* though much less nitrogen, especially as it will often render palatable some dry food that is not otherwise readily eaten.

It is worthy of mention that at a second plantation in Fiji to which the molasses system of feeding has been extended the same satisfactory results were not at first obtained, and it was only after a considerable time that the cause of failure was discovered. The molasses had to be pumped into a storage tank, but proving too thick to be taken readily by the pump it was thinned out with water by the engineer. Fermentation soon commenced, and the stock began to suffer from purging, which was for a time wrongly attributed to the molasses.

According to Wolff the whole of the albumenoids and carbo-hydrates in molasses are digestible. Taking Wolff's analyses of bran and maize in the diet that has been described about, but neglecting the cane tops, would give the following digestible constituents:—1.02 lb. albumenoids, 12.53 lb. carbo-hydrates, and 0.19 lb. fat. Taking 1 of fat=2½ carbo-hydrates, and reckoning the average weight of the stock at 1,270 lb., the constituents per 1,000 lb. live weight are:

0.80 lb. digestible albumenoids
10.24 lb. digestible carbo-hydrates including 0.15 lb. fat).
Albumenoid ratio, 1 : 12.8.

The weight of green cane tops is not exactly determined, but this is about 30 lb. per 1,000 lb. live weight, or 38 lb. per horse. At the same time the nutriment in this fodder is low, and its albumenoid ratio is only 1 : 9, so that any variation in the quantity used has but a trifling influence on the whole diet. Taking the quantity as 30 lb. per 1,000 lb. live weight, this would add to the diet 0.33 lb. digestible albumenoids and 3.07 lb. digestible carbo-hydrates (including 0.22 lb. fat).

The whole daily ration per 1,000 lb. live weight is then:

1.13 lb. digestible albumenoids.
13.31 lb. digestible carbo-hydrates (including 0.24 lb. fat).
Albumenoid ratio, 1 : 11.8; also 1.80 lb. salts.

It is thus seen that the full proportion of carbo-hydrates considered necessary by Wolff for a hard-working horse has been experimentally arrived at in these trials, but that only

*According to Wolff (Farm Foods, transl. by Cousins, p. 306) there is 57 per cent. digestible matter in oats, while molasses contains 64 per cent.

half the orthodox proportion of albumenoids has been found necessary, and only half the fat. Probably the warmth of the tropical climate renders the small proportion of fat sufficient, but the satisfactory results obtained with the reduced proportion of albumenoids prove that the current theory on the matter is erroneous.

The conclusions that can fairly be drawn from the trials that have been made are:

1. That for working horses the sugar in cane molasses is a satisfactory substitute for starchy food, being readily digested and transformed into work.
2. That 15 lb. of the molasses can be given to a 1,270 lb. working horse, with advantage to the health of the animal and to the efficiency of its work.
3. That it produces no undue fattening, softness, nor injury to the wind.
4. That the high proportion of salts in it has no injurious effect.
5. That an albumenoid ratio as low as 1 to 11.8 has proved highly suitable for heavy continuous work when a sufficient quantity of digestible matter is given.

TABLE of Analyses.

	CANE MOLASSES. (FIJI.)	WHEAT BRAN.	MAIZE. (GRAIN.)	GREEN CANE TOPS.	OATS.
Digestible albumenoids	2.5	10 8	8.0	1 1	8.0
Do carbo-hydrates	61.5	42.3	67.5	9.5	42.5
Do fibre	0	2.1	1.1	4.4	2.2
Do fat	0	2.4	4 0	0.3	4.3
	64.0	57.6	80.6	15.3	57.0
Indigestible albumenoids	0	2.8	2.1	0.6	2.4
Do carbo-hydrates	0	6 8	1.1	4.1	15.3
Do fibre	0	12.6	1.2	3 0	9.0
Do fat	0	1 0	0.7	0.3	0.9
	0	23.2	5.1	8.0	27.6
Water	26 0	13.6	12.7	75.2	12.4
Ash	10 0	5.6	1 6	1.5	3.0
	100.0	100.0	100.0	100.0	100.0

The analyses of bran and maize, as already stated, are from Wolff, those of molasses and cane tops have been made in the Sugar Company's laboratory, the separation into digestible and indigestible constituents in the cane tops being based on Wolff's analysis of sorghum.

[In a note accompanying this article, it is stated that "since it was compiled, the system has been continued in Fiji and extended to other places with equally satisfactory results."—Ed. Planter's Monthly.]

THE ECONOMIC CULTIVATION OF CANE IN AUDUBON PARK.

The economy and efficiency of the use of improved implements in the cultivation of cane has been clearly demonstrated by the following experiments:

Seven years ago Mr. Mallon brought out to the station a cultivator designed to work the middle of the row at one passage. We were then using the disc cultivator and double-mould board plow. Not having seen the results of the use of the implement, and valuing too highly the experimental plats in cane, to submit to measure whose effects then seemed to be problematical, we declined personally to use it, but consented to let him try it on a limited scale. Accordingly one plat, about one acre in extent, was assigned him, and every time we cultivated our plats, he cultivated his. His work and its effects upon both soil and cane were closely scrutinized and we were agreeably surprised to find that during cultivation his soil was better pulverized and his cane more vigorous and verdant during growth than ours. At harvest all doubts were dispelled by the increased yield of tonnage without detriment to the sugar content. These results changed all of our plans for cultivation. We at once determined to discard all kinds of plows in cultivation and adopted the following general plan, which we have rigidly preserved ever since, except in a few experiments devoted exclusively to cultivation, viz.: As soon as a stand is secured in either plant or stubble cane, the dirt is returned and the middles split out with a two-horse plow and the latter then sent to the tool room, to remain until the next season. The first cultivation is made by straddling the cane with the disc cultivator, using three unequal discs, running them very shallow and throwing very little dirt to the cane. The middle or diamond cultivator follows, working completely the middle of the row. In this operation, both mules walk between the cane.

The next cultivation is made in the same way, or if the cane has grown considerably and requires more dirt, the three unequal discs are removed and two or three of equal size are substituted. These discs can be dished to throw much or little dirt. Having displaced the three unequal discs with those of equal size, the cultivation continues with them followed immediately by the diamond or middle cultivator until "lay by" is desired. Then a single large disc is substituted on either side for the smaller equal ones on the disc cultivator, and the two forward shovels on the middle cultivator are turned up, leaving only three for work, and with these the cane is laid by. This system of cultivation has been pursued for six years on the station with the most gratifying results.

Five years ago a plot of ground was laid off and devoted for two years to experiments in cultivation, using the above system in every alternate three rows and a two-horse plow in the rest. The results were a startling surprise to us all and were

reported to the Sugar Planters' Association at one of their meetings in '96.

When reported it was suggested that we compare other methods and not confine ourselves to the two-horse plow.

Accordingly it was decided to extend the methods. A plat of ground containing seventy-two small experiments was selected. The cane was planted and an excellent stand all over the plat secured. Five different methods of cultivation were adopted and were begun as soon as a stand of cane was secured, before breaking out the middles.

I. The middles were split out with two-horse plow and all subsequent cultivations performed with this implement.

II. The middles were split out with two-horse plow and the subsequent cultivation done with a disc cultivator and two-horse plow.

III. The middles were split out with two-horse plow and all subsequent cultivation performed by disc and middle cultivators.

IV. The middles split out with double mould board plow and after operations done with disc and double mould board plow.

V. No plow used at all. Middles split out with middle cultivator and after cultivation with disc and middle cultivators.

These experiments were begun in 1897 with plant cane, continued in 1898 with first year stubble and left for second year stubble in 1899, but the freeze of February last destroyed the stand and deprived us of the third year's results.

As before remarked, the freeze prevented a continuance of these experiments in 1899. Putting the results of the two years together it is found that No. V is slightly in lead, followed closely by No. III. The following table gives results:

YIELD OF TWO YEARS IN TONNAGE.

No. 1—62.88 tons.
No. 4—69.61 tons; gain of 6.73 tons over No. 1.
No. 2—70.50 tons; gain of 7.71 tons over No. 1.
No. 3—73.72 tons; gain of 10.84 tons over No. 1.
No. 5—74.45 tons; gain of 11.67 tons over No. 1.

Figures speak more forcibly than words. The true principles of agriculture require a deep and thorough pulverization of the soil, proper fertilization and shallow but rapid cultivation, and sugar cane is no exception to this general rule If your soil be thoroughly broken in the fall and thrown into high ridges, the middles well opened and quarter drains cleared out, spring will find it in excellent tilth. This tilth must be maintained, hence in off-barring cane or stubble, avoid throwing the dirt flat, but always keep the middles well ridged up. When the latter area reversed it will be found that the tilth still remains, and subsequent cultivation is but a maintenance of this tilth. With the disc cultivator much

or little dirt can be thrown to the cane, while the middle cultivator can be regulated so as to run deep or shallow, and its shovels arranged so as to have much or little ridge. By the use of these implements a minimum amount of roots are cut, moisture is conserved and microbic action encouraged. All plant food is prepared by microscopic organisms, which teem in fertile soils of excellent tilth. The tankage, the cotton seed meal, the stable manure, and all other kinds of fertilizers must be converted into soluble forms before they can become available by plants. All this is accomplished through these organisms, and it should be the aim of every planter to encourage their multiplication as rapidly as possible during the growing season. It is known that fine pulverization of soil, aeration and moisture (not standing water) contribute to rapid multiplication. These microbes must have air, and hence abound chiefly in upper layers of the soil. When soils are deeply inverted by the plow, they are killed in large numbers. When soils are cloddy, their increase is necessarily checked, since moisture cannot circulate freely through them.

These are facts easily demonstrated, and in our experiments it was found that there were greater numbers of microbes in the finely pulverized soil of the cultivators than in the cloddy soils of the plow.

Again, the roots were less severely pruned and moisture better conserved with the cultivators; important factors during a prolonged drouth. The efficiency of the cultivators can hardly be questioned.

The economy may be shown by stating that in five-foot rows our two cultivators cultivate ten acres per day, with twelve acres in six-foot rows. With this experience I have no hesitancy in saying that in average reasons two pairs of good mules will cultivate eighty acres of land.

I further believe that if every planter should adopt this method of cultivation, to be used after a thorough preparation of his soil, that the yield of cane in the state would be increased from five to ten tons per acre.

REMARKS.

The years in which these experiments are recorded were very much unlike each other, as will be seen by the weather record.

Eighteen hundred and ninety-seven was a fairly good year both for tonnage and sugar content. The rainfall was light, but fairly well distributed, being rather small for the summer months, the season of growth. On account of the prevalence of fever in New Orleans grinding was commenced very late.

Eighteen hundred and ninety-eight was notorious for excessively green cane. The rainfall was excessive during the fall months, and carried the cane into the grinding season gorged with moisture and exceedingly immature.

Eighteen hundred and ninety-nine was ushered in by the

severest cold ever known in this latitude, destroying nearly all of the stubble and seriously injuring the seed cane. The crop was accordingly very small. In the early part of the fall a frost injured the standing cane in the upper part of the state, again reducing the crop. In the lower part of the state the cane was unhurt, and the tonnage of sugar content, where good stands prevailed, were both fair. It was a memorable year to our sugar planters.—La. Planter.

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SUGAR, ITS IMPORTANCE AS REGARDS THE NOURISHMENT OF THE PEOPLE.

Under the above title, or rather its German equivalent,* a most interesting pamphlet or little book of 160 pages has just lately been published in Berlin. The author is Dr. Theodor Jaensch, and it would be well if someone would undertake to write a similar little volume for the instruction of English-speaking people. We have meanwhile thought it advisable to present our readers with a tolerably full summary of the most useful portion of its contents. The issue of the book has already exceeded ten thousand, and is certain to go very much further.

The opening chapter of the pamphlet is devoted to a simple description of the necessary conditions of life, its chemical and physical activities, and the resulting change of matter, which is converted into heat, energy, &c. The substance thus consumed must be continually replaced in the body by introducing a fresh supply of food. In order to constitute a means of nutrition the substances introduced have to fulfill two purposes:—

1. They have to build up the body.
2. They have to produce heat or energy.

The question to be settled is which food is on the whole most suitable for this end.

As regards the substances classified under No. 1, it is essential that they shall contain the same elements which form part of the body, viz., carbon, hydrogen, oxygen, nitrogen, sulphur, prosphorus, chlorine, and certain metals, as potassium, sodium, calcium, magnesium, and iron. The author discusses at some length the physiological laws governing nutrition, and finally sums up with the conclusion that suitable means of nutrition are:

1. For building up the body:—water; blood salts; albumen (partly); fat (slightly).
2. For producing energy:—oxygen; fat, grape sugar; albumen (excess); gelatine.

For incorporation of the food in the blood nature has provided two means, the digestive organs, and the lungs assisted by the external skin. The lungs and the skin carry oxygen into the blood. The digestive organs convert the food into a liquid mass, from which the necessary constituents are then

introduced into the blood circulation. The most important food is water, which forms a constituent of a great many solid foodstuffs and of course of the usual drinks. The necessary blood salts are contained partly in water and partly in the other foods, especially plants and vegetables. The remaining nutritious substance, albumen, is not capable of sustaining the body alone, and plays a much less important part than was formerly supposed, although it is indispensable to the body. It is only partially consumed, and so the maximum energy and warmth are not obtained from it. Albumen, to be useful, has to be rendered soluble, which of course means work, and, therefore, the employment of heat. The writer then enumerates the different sources from which albumen and similar bodies are derived. The fats are combustible substances, which require the greatest work for their digestion, but produce the most heat. Coming to the ultimate substance for producing energy, namely, grape sugar, the question arises: Where does it come from and what part does it play in nutrition? Physiological researches teach us that grape sugar is the form into which a whole class of nutritious substances are converted before passing into the blood. This group is known as the sugar-forming substances, farinaceous bodies, carbo-hydrates. They are contained in milk, fruit, bread, potatoes, &c. Milk sugar, fruit, cane sugar and starch, which are contained in many foodstuffs, are easily converted into grape sugar before entering the blood. Now what happens to the grape sugar before entering into the blood circulation? According to chemical investigation the blood never contains more than one to one and a half part in a thousand of grape sugar; any larger accumulation does not take place, and therefore large quantities must either be stored or used up directly in the body. Both operations take place, and it is found that part is consumed directly and produces energy muscular work), and part is stored up by the body by conversion into fat, therefore, in a sense, sugar may be regarded, like the fats, as a building-up substance, and also as an energy producer. In spite of this and of the fact that agriculturalists use sugar as a means of fattening their animals, it is regarded by the majority of people as an ingredient only to be used as a delicacy instead of a useful means of nutrition. In the same way, it is not known that sugar is as nutritious as meat, butter or potatoes, and cheaper than these with the exception of potatoes. As a consequence of careful investigation, these views have, however, been considerably changed of late. Ranke gives certain figures respecting the substances necessary for nutrition of the human body, and Rubner confirms his statements, and divides people and their nutrition into three classes, viz:—

1. Men with no special physical labor (doctors, clerks, tailors, etc.)

2. Men with ordinary physical labor, working 8 to 9 hours (laborers, mechanics, carpenters, and such like).

3. Men with occupations requiring arduous physical exertion (shoemakers and such like). He gives the necessary nutrition as follows:

	Class 1. Grammes.	Class 2. Grammes.	Class 3. Grammes.
Albumen	123	127	165
Fat	46	52	70
Sugar substances	377	509	565

This shows the importance of sugar as an energy producer, surpassing that required in the form of fat and albumen.

Professor Konig also gives the necessary amount of nutrition for a grown-up man as follows:

Nutritious substances containing nitrogen (albumen, etc.).—120 grammes of which 108 are digestible.
Fat .. .. 56 grammes of which 53 are digestible.
Sugar substances ...500 grammes of which 475 are digestible.

A chapter entitled "Sugar in relation to other foodstuffs," is devoted to the comparison of the values of the foodstuffs, as far as can be given in figures, chiefly with regard to units of heat which they yield on being consumed, and also in relation to their capability of forming "animal starch" or "glycogen," a body chemically analogous to the subar substances, which is formed in all animal bodies by digestion, and is afterwards converted into grape sugar. Sugar, besides increasing the energy of the muscles, has a special advantage over the other foodstuffs, that is, it has a rapid, almost instantaneous action on the muscles. When the muscles are exercised the accumulated glycogen is first used up. When this has been consumed and not replaced by means of food, the muscles become affected, producing the feeling of weariness. The Italian physician Mosso has devised an arrangement for measuring the capability of work of the muscles, to which he gives the name of "Ergograph." For this purpose the flexible muscles of the middle finger are generally utilized, and their work consists in raising and lowering a certain weight in equal periods of time. The energy and endurance of the muscle is indicated by the size of the weight, the number of times it is raised and lowered, and the height to which it is raised. As a rule the height to which the weight is raised diminishes gradually and pretty regularly during the period of exertion, and increases again if the muscles have recuperated, i. e., after they have been provided with nutrition. Allowing longer intervals of rest, the initial height is increased, and all the more the longer the period of rest. If the periods of rest are shorter, however, the height always decreases at each successive start. By marking these heights on paper a curve may be obtained indicating tolerably clearly the strength and endurance of the muscles. Mosso, in conjunction with Paoletti, made by means of this arrangement experiments extending over six years, on the influence of sugar on the muscles, and he found that the work produced by the muscles when using

sugar decreased in a very much less ratio than without its use; and that when introducing sugar as nutrition to muscles which were already tired, they were at once capable of further work. The English physician and anatomist, Harley, obtained similar results. Hermann Frey, of Bern, published in 1896 a series of experiments with the use of alcohol, but also conjointly with sugar. A comparison of these is very interesting. They prove sugar to be much more advantageous than alcohol, while it does not possess the concomitant disadvantages of the latter. His researches are still more valuable as he experimented on grape sugar, water, dextrine, and artificial sweetening substances as "saccharine," etc. In the case of grape sugar the highest possible degree of work is obtained after an interval of a minute. Dextrine—which has to undergo more changes before affecting the muscles—required eight minutes to effect the same work. Water and the artificial sweetening substances on the contrary remained without action. This latter result is not only of importance as confirming the already known fact, the worthlessness of saccharine as a nutritious body, but because it follows that the increased working capacity produced by sugar is really due to its nutritious properties and not to the effect produced on the nerves by its taste, which resembles that of a dilute saccharine. Dr. Schumberg, of Berlin, carried his researches further than Mosso, who only experimented on himself, so that all influence of the mind upon the will was excluded. He employed the most varying subjects for experiment including men with both weak and strong muscles, and they were also kept in ignorance of the purpose of the experiments. In some experiments, solutions of "dulcine" (an artificial sweetening substance) were used instead of solutions of sugar. The results were that when even small quantities of sugar were taken the capability of the muscles for exertion was increased. Further experiments enabled Dr. Schumberg to find out the share which sugar had in increasing the work of the muscle, and in removing the feeling of weariness. His conclusions were as follows:

"It is confirmed again, even when any psychological influence is entirely excluded, that the administration of even small quantities of sugar (30 grammes) increases in a short time the capability of the muscles, because sugar is easily absorbed and reacts very quickly, thus forming at once a real means of nutrition for the muscles, and also—and this is the new and most valuable result—because it is capable by its influence on the nervous system of removing the feeling of weariness." According to the experiments, dulcine, which was also tested, is as valueless in this respect as water. Grandeou, a French student, recently made researches, using horses as subjects, and found that the power of work was really obtained from foodstuff not containing nitrogen, and especially from sugar, while the nitrogenous substances were only of value for repairing the loss caused by the slight wear

and tear of the muscles. He obtained the largest amount of work with food poorest in nitrogen and richest in sugar, and also found that the large quantities of sugar did not increase thirst. The value of all these results and their application in practical life is self evident, and it is only natural that the attention of the army administration was attracted by them, and experiments were made in the laboratory and among the troops, so as to find out how far these results could be utilized in the nutrition of the soldiers. Dr. Leitenstorfer, of Metz, experimented on the soldiers with good results, and he draws the following conclusions:

"Scientifically, a daily ration of 50 to 60 grammes of sugar to the soldiers' food already indicated a favorable influence on the energy of the men by showing that the pulse and the breathing figure was lower during work with men who were fed in this way than when not so fed with sugar, and also that they increased more in weight. The favorable influence of sugar upon the muscles and the heart in increasing the endurance was very noticeable."

It was further proved by practical experiment that—

1. People take sugar with pleasure.
2. Sugar quenches hunger and thirst.
3. Sugar, on account of its being so readily absorbed, is a means of rapidly restoring the energy of men when hungry, weak, and exhausted.

In consequence of this, Leitenstorfer recommends the use of sugar in the army in the following manner:—As an addition to the daily food to increase its nutritive value, and thus save meat in manoeuvres and in battle. As a reserve for the men and as a store for fortresses, military hospitals, and ships, &c. As a temporary means of raising energy and animation during a march, as well as an item in the stores of the regiment, especially of the medical staff.

Sugar has an advantage over all other food stuffs, in that it can be stored in a very small compass and it does not deteriorate. Dr. Leistikow has also made experiments with similar results. Sugar plays an important part as a food stuff in the English and French armies. In England the daily amount of sugar consumed by a soldier is 37.7 grammes, while in France he gets 10.5 grammes to his coffee when in garrison, 21 grammes when manoeuvring, and 31 grammes when on active service in the field.

It is natural to expect sugar to be used as an energy producer in the pursuit of different forms of sport, and such proves to be the case. In fact it is rather strange that it was not used much earlier, because Fick and Wislicenus both proved its superiority as a food stuff. They gave several instances of sugar being used by many employed in arduous pursuits, such as those engaged in hunting the chamois in Switzerland, who take nothing with them but sugar and bacon, as it is, as they say, more nutritious than other foods, and they also mention instances of those engaged in training

for sports, &c., and its use by people in different parts of the earth.

Birnie (Holland) introduced sugar into training for rowing, he having observed that people in the neighborhood of Palembang (Dutch East Indies) always used sugar, and never made a long journey by water rowing without it. It is also well known in all tropical countries where sugar cane is grown that the colored workmen on the plantation and in the factory consume a large amount of sugar and of sugar juice, from which they obtain much energy, and during the season they put on weight, although the work is by no means light and they very often commence in a very emaciated condition. An instance of the effect of sugar in cycling by Dr. Coulton, a French doctor. He undertook, with two friends, a five days' ride with heavy baggage, of which he carried 60 lbs. himself. The heat was very great, and the road frequently led up steep mountain slopes. Dr. Coulton subsisted during the time alternately on "sugar diet and other foods, the former consisting of 400 grammes of bread and 250 grammes of sugar." The result was that on the sugar days, in spite of the difficult tasks of a long journey (37½ miles daily), he only felt slightly tired, while on the days when he had the other foodstuffs, travelling through the same country, and at the same speed, he was quite exhausted. It is evident that sugar may be used to advantage in all cases which call for great exertion.

Passing on to the effect of sugar in mental work, the author mentions that experiments do not appear to have been made as to the influence of foodstuffs on the mind. It is highly probable, however, that sugar would be of value on account of its easy digestibility. Digestion takes away the circulation of the blood from the cells of the brain, and sugar would be a suitable foodstuff or stimulant for mental work on account of its practically not affecting the digestion at all. It would be of value to compare the effect of sugar on the activity of the brain with that of coffee. As far as tea is concerned it is always taken sweetened, and it would be of scientific interest to knew whether its stimulating action is due to the alkaloid "thein," or to sugar.

In a chapter headed "The nutritious value of sugar compared with other foodstuffs," many details and tables of figures are given comparing the values of nutritious bodies, including their relative prices. The pamphlet also contains interesting chapters on "Sugar and the teeth," "prejudices against sugar," and on the coloring of sugar, i. e., the blueing and one on the artificial sweetening substances such as saccharine, etc. In the latter several facts relating to the disadvantageous effect of these preparations on the digestive organs, are stated to have been proved by experiments.

The author remarks, in regard to the relation of sugar to vegeterianism that, being absolutely a vegetable food, it would have been expected that the knowledge of the nutritious and wholesome properties of sugar would have been specially

recognized by vegetarians, but this does not seem to have been the case, as he could not find anything published thereon. Sugar must often be suitable for supplying certain defects which are much felt in using vegetarian food. It would no doubt very much simplify the problem of the maintenance of a vegetarian diet, on account of its being the most easily digestible of all foods, and the most prominent in its special property of diminishing the need of albumen. The little attention which sugar has hitherto received from vegetarians is partly explicable by the effect of the views of Theodore Hahn. It is to be wondered at however, that the attention which is being paid to the progress of the physiology of nutrition has had no effect in changing their views as regards sugar, especially as Hahn even adhered to the old over-estimation of albumen, and rejected any foodstuff as being valuable as a nutritious body if it did not contain nitrogen.

Sugar has attained a more important role of late as regards its use as a medicine, which, however, according to the author, has not reached its fullest extent. Contrary to the present prejudices against sugar, it was formerly of as much value to the physician as to the layman.

Haufeland devoted a special part of his celebrated work, "Die Kunst, das menschliche Leben zu verlangern," to sugar, and gives it a prominent place in his book, "Haus und Reise-Apotheke," and the quotation is given in full by Dr. Jaensch as follows:

"Sugar is certainly one of the first articles in our domestic medicine; so many are its virtues and so many its applications in divers cases. It is a salt, and has the useful properties of all salts in illness, at the same time however it nourishes, and hence has not such a weakening action on the stomach as other salts. Sugar is one of the best cooling agents. After the body has been overheated, there is nothing better than to drink two lumps dissolved in a glass of water. Likewise, also in fevers and illness accompanied by high temperature, especially also after violent action due to fright, anger, or passion, when it has the power of soothing and causing evacuation of the excited bile. It may also be used for reducing the too great heating properties of such substances as coffee, which, drunk with much sugar, is less heating than without. Sugar dissolves phlegm. It is a prejudice that sugar makes phlegm; it does this only in the case of very frequent and long-continued use, by finally weakening the stomach, but its immediate action is that of a solvent; thus in the case of congestion of the stomach or the chest, catarrh, and cough with defective expectoration, nothing is more wholesome than to drink largely of sugar solutions. Sugar, taken in a large dose, purifies the stomach and purges. It is serviceable in all cases of overheating. After a rather heavy meal, I have often taken two lumps of sugar dissolved in water, which effectually removed all ill effects. It is the best digestive known. Sugar promotes digestion, like any salt, by causing slight irritation. Meat can be salted with

sugar, just as well as with common salt, and its digestibility is thus increased."

It is rather astonishing to find no mention of sugar as a medicine in recent literature. Its only use is in the form of "Sirupus simplex" as a sweetening agent. In the first half of the present century it was very different. Sugar was used largely for internal and external application, and also for pre venting the decay of organic matters. It was largely used for dressing wounds. Even as late as 1885, Dr. Fischer sent a report to one of the leading German journals on this treatment. Many instances of its uses in medicine, especially relating to fever, are mentioned. The following is a typical one, being a communication from Count Bernstorff to the "Berlin Rundschau," relating his own experiences.

"I will relate a special action of sugar which I have experienced. During the year 1888-89 I was stationed at Cameron as navigating officer of the cruiser "Habicht," and I contracted a bad fever during the many journeys in the marshy districts between Mimi and Old Calabar. Besides severe diarrhoea I had violent bilious fever, which, in spite of large doses of quinine, still increased. Then came a burning thirst, which nothing could quench, until I accidentally drank some sugar and water. The result was quite surprising; the tormenting feeling of thirst disappeared, or was at any rate very much mitigated, then the over-production of bile diminished, and I took no other food than sugar and water, about ten to twelve glasses a day, so that for five days I literally lived on sugar. Later on, when I have had recurrent attacks of fever, even after I had been some years at home, I have always had recourse to the same treatment, and always with the same result. My communication to a physician in Ploen caused him to recommend sugar and water to the inhabitants of a large village on the Ploener lake, who were often attacked with fever. Good results always followed. The fever appeared there after the draining of the lake, a large part of the land thus becoming dry. This caused a kind of malaria, like that described as having appeared during the construction of Wilhelmshafen."

The author concludes by mentioning the effect of sugar on the nerves, calming and thus producing sleep.

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A PORTO RICO UP TO DATE SUGAR PLANT.

At this season of the year all "Haciendas de Cana" are spheres of activity, but if you want to fully realize the importance of the sugar industry in Porto Rico it is necessary to visit the Canovanes Central sugar factory which grinds the cane of many farmers. It stands like a little island in the midst of an ocean of cane, stretching as far as the eye can reach in every direction. It gives employment directly to a large number of laborers, and indirectly through the farmers, to practically the whole population of the district. It is successfully managed by Mr. W. S. Marr, a gentleman of much

experience, ably assisted by Mr. R. S. Brown, the talented chief engineer, and a competent staff of clerks and overseers, including Mr. Bunbury, well known on the island.

The directors of this important money circulating (it might almost be said life-giving) enterprise, which has been maintained through years of depression, loss and uncertainty as to the future, with Anglo-Saxon tenacity, have never failed to realize that up-to-date appliances are the best weapons with which to fight low prices. A year never passes but some improvement designed to increase the efficiency of the usine or increase its output, is introduced.

The plant as it now stands, is capable of grinding 1000 tons of cane per day of 24 hours. It is well and conveniently arranged, and without using any full but double crushed and macerated megass, has an ample steam supply, furnished by two 500 horse-power water tube boilers.

Since last season a large sugar store has been erected; new filter presses of improved type, automatic strainers, sugar-conveyers, granulating cistern, and numerous other minor improvements have been introduced; but the greatest of all has been the installation of an one-hundred and fifty thousand gallon "Lillie Evaporator," replacing a triple-effect of the standard type which had done good service in its day, but was out of date.

The "Lillie Apparatus" with a minimum supply of exhaust steam concentrates the clarified juice to the thickness or density required previous to being boiled to sugar in the vacuum pan.

It is the invention of Mr. S. Morris Lillie of Philadelphia, who has brought such skill and thought to bear upon the subject of economical evaporation of liquids, both from a scientific and practical engineering point of view, that he has got out an evaporator which is quite original in its conception, and in all its details, more efficient than, and superior to, the old type of double and triple effect.

The "Lillie Apparatus" although quite a recent invention, is rapidly superseding all other evaporators in the leading sugar refineries and cane factories all over the world. No fewer than five have been ordered from the Hawaiian Islands within the last twelve months. The advantages claimed for it are:

1st. That the circulation is mechanical, so that the juice or liquor is never at rest for a moment, until the requisite degree of concentration has been reached, and it leaves the apparatus.

2nd. That instead of a vessel partially filled with juice, and evaporating only from its surface, there is a thin film constantly passing over steam tubes and throwing off vapor on every side.

3rd. The operation is automatic and the juice passes from vessel to vessel, and out at the end: without the intervention

of any attendant, opening and closing valves, who may be careless and forgetful.

4th. "Entrainment," by which in many multiple sugar juice evaporators, much sugar is carried away unseen in the vapors, ceases to be a danger.

5th. By a system of forward and reverse working the tubes do not get incrusted with lime scale, and never need to be scraped. This ensures Sunday as a day of rest to the men who would with an ordinary evaporator have to spend the day inside scraping the tubes in order to ensure satisfactory work during the week.

6th. If business prospers, and the supply of cane outgrows the evaporating capacity of the "Lillie," it can be enlarged without difficulty, and at small expense. This cannot be done with other types of juice evaporators. If they get too small there is no remedy but to throw them out, and get an entirely new apparatus as the Canoranas factory had to do.

7th. The juice is only a few minutes, six or seven, passing through a "Lillie Apparatus." In a Standard Triple effect it may be hours. These are some only, of the special merits of Mr. Lillie's invention.

As erected at Canoranas it presents a very handsome appearance, and Mr. Marr says it is giving excellent results without having caused any of the trouble that some new appliances do on their first introduction. Mr. Robert A. Macfie of Luquillo is the local agent for the Sugar Apparatus Manufacturing Co., which supplies the apparatus.

Old machinery as well as the new, seems to work smoothly at Canoranas; and there is a fascination about watching the cane being drawn continuously into the mills at one side of the building, and sugar going out in sacks at the other side.

Altogether, what with the hum of machinery, the whistling of the locomotives as they come and go with loaded or empty cane-trains, and the continual movement, there is an air of business, quite out of harmony with prevailing ideas further north of the easy going tropical life we are supposed to enjoy here, with everything put off till tomorrow, if not the day after.

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TEN YEARS EXPERIMENT WITH SUGAR CANE.

By Dr. W. C. Stubbs, at Audubon Park.

We extract as follows from Bulletin No. 59, second series:

FERTILIZING REQUIREMENTS OF SUGAR CANE.—Went, of the Experiment Station of Java, has shown, by growing sugar cane in water, that with the absence of either iron, magnesia, lime, phosphoric acid, potash or nitrogen, the plant soon died, showing the necessity of all of these ingredients for growth.

He found that if one or more of these same ingredients were

present in insufficient quantities, the plants grew very slowly compared with those which were abundantly supplied.

The deficiency of nitrogen was soon apparent, while the absence of magnesia did not affect the plants for a long time. In the absence of iron the leaves remained yellow and became singularily curled, and the roots were very thin. On supplying the ingredient, the green color soon appeared, and the roots assumed their normal size and vigor.

In the absence of nitrogen the leaves remained pale and narrow and the roots failed to develop.

It will thus be seen that sugar cane, like other plants which have been tested, must have the above ingredients in sufficient quantities to produce healthy, vigorous plants.

In what quantities shall these ingredients be supplied? How far do our cane soils furnish them in ample quantities for the growth of maximum crops? It is well known that all soils furnish iron in great abundance for all crops. It is believed that most soils furnish enough soluble silica, magnesia, lime and sulphuric acid to meet the requirements of all crops. Should the last two be deficient, they will be incidently supplied by the use of acid phosphate. Lime is frequently applied to soils, not to supply plant food directly, but to react upon insoluble plant food, rendering it soluble. Also to correct acidity, to humify and nitrify the organic matter, to flocculate heavy clays, to bind loose sands, etc. Such actions are purely mechanical, and when lime is thus used it may be regarded more as a physical amendment than a chemical addition.

As before asserted, the three principal ingredients which are possibly deficient in an available form in soils are: Nitrogen, phosphoric acid, and potash. To meet these probable deficiencies commercial fertilizers have been introduced, and are now used throughout the civilized world. They may contain one, two, or all three of these ingredients. When all three are present, the fertilizer is usually styled "complete," though the proportions of the three ingredients to each other may vary greatly. When only one or two of these are present, the fertilizer is usually denominated as "partial" or "incomplete." Complete fertilizers should vary in the proportion of the ingredients to each other, according to the requirements of the crop for which it is to be used, and to the demands of the soil to which it is to be applied. The requirements of the crop can easily be determined by a careful chemical analysis, but the demands of a soil to grow certain crops can only be told by direct experimentation in the field. Chemical analysis can determine the amount of food material in a soil, but it may be locked up in insoluble forms, and no positive method has yet been discovered by which the exact amount of available plant food in a soil may be accurately estimated. Hence, field tests are necessary to determine the needs of soils to grow certain crops. These ingredients are presented to the trade in different forms and combinations, some natural and some artifi-

cial, and they are by no means equally as available as plant food. Nitrogen is supplied to the trade in many forms.

First. As nitrate of soda; gotten in large quantities from the rainless districts of Chili. It is readily soluble in water, and hence its use must be attended with great care and caution, lest it be leached through the soil beyond the reach of the roots of the plants it was intended to feed. It is therefore used mainly as a top dressing, in small quantities at a time and at short intervals apart. This is the form into which all other forms of nitrogen must be converted before they can be utilized by the plant. Hence, in applying other forms of nitrogen great care must be exercised to obtain those conditions of the soil, which will rapidly "nitrify" them into nitrates. Hence the necessity of shallow and frequent cultivation rapidly multiply the nitrifying germs in the soil, to let in the air, and to conserve the proper amount of moisture.

Second. Sulphate of ammonia; our richest, and probably the best form of nitrogen for sugar cane, but, unfortunately, too costily at present to admit of extensive use. It is a by-product in the manufacture of coal gas in our cities, and also of the destructive distillation of bones to make "bone black."

Third. Dried blood; a valuable product of the slaughter house; red or black in color, according to the degree of heat used in drying it.

Fourth. Tankage; consisting of the refuse of a slaughter house, steamed, dried, and ground, and sold as a fertilizer. As usually sold in this State it has, besides nitrogen, a goodly quantity of phosphate of lime.

Fifth. Fish scrap; the steamed, dried, and ground residue of fish, which are caught in quantities on the Atlantic and Gulf coasts, primarily for the oil which they contain. After the oil is extracted the dry, ground residue is sold as a fertilizer chiefly to the manufacturers of commercial fertilizers. It has the bones of fish present, and therefore contains phosphate of lime with its nitrogen.

Sixth. Bones; raw and steamed, finely ground, are extensively used in some countries as a fertilizer. It contains 3.5 per cent. nitrogen to 22.25 per cent. phosphoric acid in form of phosphate of lime. It finds a very limited market in the South.

The last four are of animal origin, while the first two are usually denominated as mineral forms of nitrogen. The following are of vegetable origin:

Seventh. Cotton seed meal; residue coming from the kernels of cotton seed after the oil is extracted. It should find in the South, as it does in the North and in Europe, its greatest use as a food stuff, since only a part of its fertilizer value is lost by passage through the animal. It contains, besides its 7 per cent. nitrogen, 3 per cent. phosphoric acid and 2 per cent. potash. There are other vegetable meals, the residues from seeds used to furnish the oils of commerce, e.g.: linseed meal,

castor pomace, etc., but they are rarely found for sale in the South.

Phosphoric acid is supplied to the planter in several forms.

First. Bones; described above.

Second. Mineral phosphates, ground to a fine powder and sold under the usual name of "Floats."

Third. Natural guanos; coming from rainy sections of the tropics, and believed to be the ordure of fish-eating birds, with the nitrogenous portions washed out. The above are all insoluble, and therefore of doubtful availability when applied to growing crops.

Fourth. Thomas slag; a by-product in the manufacture of iron and steel from phosphorized iron ores. It also contains a goodly quantity of lime. It is claimed to be intermediate in solubility between the insoluble forms already given and the (fifth) soluble phosphates, such as "acid phospate," "dissolved bones," "super-phosphate of lime," etc. All of these have been treated with acid to convert the tricalcic (insoluble) phosphate into the monocalcic (soluble) phosphate.—Sugar Cane Journal.

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PROGRESS IN JAMAICA.

The British Colony of Jamaica in the West Indies is to have an experiment station established at Kingston. At a meeting of the Jamaica Agricultural Society it was resolved to ask the Government to establish a station on the lines published below, which will probably be done. The colony has long had an agricultural and also a botanical station, but nothing in the line of a well equipped experiment station, as are established in other countries.

"We are of opinion that the requirements of the Colony may be best met by the establishing of a station where first agricultural problems, with which the practical planter and penkeeper are constantly confronted, may be systematically studied; and where secondly, the services of those engaged in the management, as well as the material and the appliances of the station, may be utilized to great advantage in giving instruction to pupils drawn from the various classes of the community interested in agricultural pursuits.

"It is unnecessary to dwell at great length on the advantages which should follow from the formation of an Agricultural Experiment Station, but we may point out that institutions of this character have proved to be the most useful means yet devised for aiding the practical agriculturists in the United States and Canada in which countries these stations have done much to promote and foster agricultural advancement.

"Such a station for Jamaica should have for its object the study of the staple crops of the colony, the consideration of the conditions under which these are grown, and demonstrations of the results of different methods of cultivating, fertilizing or manuring, or any operation connected with the crop.

"In addition to the study of crops grown largely for export, attention should be given to the products grown for local use, particularly, those used for food.

"Improvements in the kind of plants grown and the study of improved varieties which may be introduced from without should also occupy the attention of the station workers.

"Special efforts should be made to maintain demontration plots, whereon should be shown as continuous object lessons, correct methods of cultivating crops of local importance.

"It is desirable that attention should be given to the economic value of the different methods of working, of cultivating, manuring and general handling of crops, as well as the value of new varieties of plants; and in the publication of the results, as far as possible, reference should always be made to the difference in the monetary value of these methods or varieties, for the information and guidance of practical planters: indeed this should be the keynote of a large proportion of the work of this kind,—the determination whether certain operations, or the introduction of certain varieties of plants will or will not pay.

"The station will also afford facilities for the study of the enemies, pests and diseases attacking crops, a subject of growing importance and one for which there is very little provision in the colony to-day.

"Such commercial considerations as the methods of preparing and packing products for export also come well within the province of the station work.

"The care and management of farm animals and dairying demand attention: provision should be made for carrying on work on these lines in connection with the station and a distinct and properly equipped Veterinary Department should be ultimately formed at the station. At the outset, however, we are constrained by questions of economy and finance to suggest that this veterinary side shall be started in a small way only, trusting that as soon as the station is found to be firmly established, veterinary questions will receive the attention they deserve, and that proper provision will be made for this work at an early date.

"Publications setting forth the results obtained at the Station should afford useful information to those now employed in dealing with agricultural products.

"Instruction in agricultural science and the arts of husbandry should also be afforded to the youths of the colony; this instruction on the one hand should be framed to meet the requirements of the youths who are about to become planters, while on the other, it should include training for those to be actually engaged in tilling the soil and conducting manual agricultural operations. Instruction of a particular kind should be provided for those under training to be teachers in elementary schools, so that by their agency sound ideas on the

subject of agriculture may be diffused throughout the country by means of the scholars whom they will have to teach.

"This brief outline will serve to indicate in a general way various functions which we believe should be discharged by an Experiment Station in Jamaica."

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IMPROVEMENTS IN SUGAR CANE CULTIVATION.

As regards agriculture, in which, at any rate as regards the cane industry, there is the greatest field for development, it can hardly be said that much progress has been made. In the Hawaiian Islands, phenomenal yields have been obtained on some of the estates, and in Java perhaps the utmost possible is being done, many of the plantations there being almost like gardens in respect of scientific treatment of the soil, and the extreme neatness which prevails. Everywhere the problems connected with the diseases and insect pests, which so injuriously affect the yield, are being carefully studied, and with considerable results. The great results that had been expected to be immediately obtained from experiments with seedling canes by the acquisition of stable varieties of great saccharine richness, cannot be said to have been as yet attained. Still less would it be correct to take the pessimistic view adopted by the Chairman of the West Indian Committee, in his late reply to an article which appeared in The Times, and which must have been seen by most of our readers. Those best able to judge are unanimously of opinion that we are "within measurable distance" of the acquisition of at least two or three stable varieties which will as far excel even the good old Bourbon, (which under various names has been for years the staple variety of most of the cane producing countries) as the best German and French beets do the poorer root of twenty years ago. And it must not be supposed that the resources of botanical science would be exhausted, even if the present very promising new varieties obtained from seedling selection were to fail us when grown on the large scale, which it is hardly likely they will do. In our article on 1898, in the January number of 1899, we referred to a cane which was said to be locust proof and frost proof and had been consequently largely grown in Natal. Since then, enquiries which we have made led to the discovery that this cane had originally been imported from India, and that it was probably a kind called poona or pûnya, and a sample eventually obtained from Madeira, whither it had been transported, showed that it was undoubtedly a quite different variety from any of those now grown in the Western Hemisphere. The planters from whom we obtained this sample said that the juice of a cane lately examined by them showed, by the polariscope, 19.6% sugar, the density being 11.2 B. It is a thin cane but a luxuriant ratooner, 30 to 40 canes springing from one stool. Certainly the borer would seem to stand small chance of penetrating so

hard a rind. We mention these particulars to show that the attempt to derive new and valuable varieties of cane from what was probably the original habitat of the sugar cane, might probably offer great possibilities and may form another source of successful experiment.

Nitrogin, from which so much was expected, has not fulfilled the hopes of those who introduced and experimented with it. The artificial product is evidently wanting in something which is present in the naturally grown bacteria of the leguminosae, and to this must be attributed the many failures of inoculation with nitrogin, especially as compared with that by earth containing the naturally grown bacteria. A very similar want of success has attended the attempted propagation of bacteria which condition has aromatic properties of tobacco, and it is plain that nature will not all at once give up her secrets to the investigating chemist, charm he never so wisely. So long as the chemist and physiologist are unable to show why, for instance, a pigeon can take in with impunity an amount of prussic acid which would poison more than one man, we should do well to follow out assiduously and also consistently the methods of fertilizing which have served so well in the past.

A very great explanation was given a short time ago by a well-informed American expert, of the reason why farmers are so slow in many parts of the world, e.g., Australia, Bulgaria, Italy, Spain, and some of the States of the North American Union, is as follows:—"Beet is really a garden vegetable, and its cultivation requires much more time, attention, and expenditure of money than the ordinary farmer is accustomed to devote to his crops." The growth of beet in Egypt, where it is said two crops can be produced annually, will be watched with much interest.—Int. Sugar Journal.

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NECESSITY FOR SELECTING GOOD BEET SEED IN SUGAR-CANE CULTIVATION.

About a year ago I called the attention of the American sugar-beet growers to the importance of planting the best seed obtainable, no matter what the price may be. Since then I have learned, from time to time, of beet seed shipped to the United States which the beet growers of Germany and France, who are in the lead in this industry, would not touch. Time and again I see advertisements in Magdeburg and other papers calling for such seed, and I am told that in this way large quantities of second and third class qualities are concentrated at Hamburg and other seaports and shipped to foreign countries at a cheap price. As our beet-sugar industry at home is yet in its infancy, it is all important that as few mistakes should be made as possible. By taking advantage of the experience of other countries, we shall save time and money.

The sixth annual report on the experiments made with different kinds of sugar-beet seed at the experiment station at Tabor, Bohemia, in 1898, shows that forty-nine different kinds of German, French, and Austrian seeds were tested.

[The table, which we omit, showed the largest percentage of sugar obtained was 17.35; the largest yield of beets per acre, 18.44 tons; and the largest yield of sugar per acre, 2 tons and 93-100.—Ed. Pl. Monthly.]

The list referred to shows that by far the best results came from the first-class German seed furnished by the old and reliable firms of Schreiber, Klein Wanzleben, Dippe, and others. For sugar contents in the beet, these seeds were superior to all others. The French seeds did not equal them either in sugar contents, tonnage, or yield per acre. France herself imports foreign beet seeds in large quantities. In the year 1898, not less than 3,435 tons were bought by that country, for which $629,680 were paid; and of this amount 3,326 tons were furnished by Germany. In order to supply her acreage for sugar beets, comprising about 250,000 hectares (617,750 acres), France requires about 7,000 to 7,500 tons of seed. Hence, about one-half of the sugar beets raised in France are grown from German seed. The percentage of sugar in the beet from German seed varies greatly.

The difference in price between the varieties will scarcely exceed 1 cent per pound, yet the difference in the crop obtained from, say, Schreiber's seed and from Mette's or Baumeier's will be very great. The samples tested at the experiment station in Bohemia showed a difference of 2½ per cent. of sugar in the beet. But suppose the difference averages only 2 per cent., what will be the result? A factory that will, in the course of a campaign, slice 50,000 tons of beets raised from the higher grade of seed will produce 1,000 tons more of raw sugar, which, at the rate of $50 a ton, will net the stockholders $50,000 more money than if the same quantity of beets grown from a lower grade of seed had been used. I therefore repeat what I said in my former report on this subject:

Like so many other things in life, the cheapest beet seed is the dearest. It pays to get the very best, and only the very best is good enough.

I wish to emphasize this point once more by another illustration. I have in mind two American farmers, who are neighbors, both of whom have earnestly gone into sugar-beet raising. Farmer A believes, as I do, that only the very best is good enough for him, and is determined to have the best. So he makes sure that he gets first-class German seed, such as Rabbethge & Giesecke, Licht, Dippe, Schreiber, and other first class firms furnish. He uses 20 to 22 pounds of this to the acre, hence for 5 acres he needs one sack, containing 1 cwt., of German seed. One sack of such seed delivered at his farm will cost him from $10 to $11. Five acres, thus seeded, are supposed to produce 60 tons of beets.

Farmer B is of a different turn of mind. He believes in buying "cheap" and making money fast, and therefore he buys beet seed that sells at 6 to 7 cents a pound. He also uses one sack of seed for 5 acres of land, and is sure that he has saved $3. His beets come up wonderfully, and his beet fields thrive as well as those of his neighbor. When harvest time comes, he also garners in about 60 tons of beets from each 5-acre field, as does his neighbor, Farmer A, which confirms Farmer B in his view that his course in getting cheap seed was wise and profitable. But when he hauls his beets to the factory, where they are graded and paid for according to the sugar found in the juice by polarization, he discovers to his dismay that beets grown from second or third class seed will surely polarize 1, 2, 3, or more per cent. less than will those produced from first-class beet seed.

The average price paid to the farmer for beets delivered to the factory is $4 per ton and 25 cents extra for each additional per cent of sugar found over 12 per cent. Now, let us suppose that Farmer A's beets will polarize only 2 per cent. more than Farmer B's, which is not at all an unlikely supposition. This would put 50 cents more per ton into Farmer A's pocket than Farmer B gets. In other words, Farmer B invested the same amount of money in his 5 acres of land; his beet field required the same amount of fertilizers and the same amount of labor from the beginning to the end of the season. He saved $3 on every sack of seed, but when he delivered his beets at the factory and received his money for his crop, which polarized 2 per cent. less than did that of his neighbor, who had bought higher priced seed, he found that his 5 acres brought him $30 less than Farmer A received.

In conclusion, I have to observe that the demand for first-class seed has increased, because the beet-sugar industry is to be largely extended in the coming season, particularly in Russia. Hence it is expected that there will be a shortage in the supply.

HENRY W. DIEDERICH,
Consul.

Magdeburg, November 9, 1899.
—Am. Consular Reports.

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NEW DEPARTURE BY THE BRITISH BOARD OF TRADE.

Heretofore the British Board of Trade Journal, a Government publication similar to the American Consular Reports, has been issued monthly. Complaints have been freely made by the British press and by chambers of commerce that the information contained therein was often too late in reaching the public to be of much practical value, and comparison was made with the system of the United States Government in publishing daily Advance Sheets of Consular Reports. On the 14th instant, there appeared the first number of the weekly

issue of the Board of Trade Journal. Its price is fixed at 1d. (2 cents), while the price of the former monthly issue was 6d. (12 cents). Considering the admitted conservatism of the British Government in such matters, this new departure is very significant. It is undoubtedly a manifestation of the newly awakened spirit in Great Britain in the direction of greater enterprise and more modern methods to meet ever-increasing foreign competition both at home and abroad, particularly from the United States and Germany.

Equally significant is the establishment of the new "commercial intelligence branch of the Board of Trade," the following particulars of which are taken from an official announcement dated the 1st instant:

The intelligence branch of the commercial department of the Board of Trade has been established with a view to meet the constantly increasing demand for prompt and accurate information on commercial matters, so far as it can be met by Government action. In deciding to establish this new branch, the Board of Trade have been largely influenced by the recommendations contained in the report of a departmental committee composed not only of representatives of the various Government departments concerned, but also of prominent representatives of commercial interests, which was appointed by Mr. Ritchie, the president of the board, in July, 1897. The committee referred to was requested to consider and advise (1) as to the best means of collecting and of disseminating among those interested prompt and accurate information upon commercial subjects, and (2) as to the collection of samples, especially of goods of foreign manufacture competing with British productions, and the exhibition of such samples to manufacturers and traders in this country. As a result of their deliberations, the committee recommended under head 1 the establishment of a new office, under the Board of Trade, on lines which the board have followed generally in the creation of the intelligence branch, and this branch is consequently intended to become a center at which information on all subjects of commercial interest shall be collected and focused in a form convenient for reference. In addition, it will be the duty of the branch, as far as circumstances permit, to afford information in reply to all inquiries on commercial matters which may be addressed to it, whether written or verbal. The "intelligence branch" will endeavor, on application being made to it, to supply information with regard to the following subjects, viz: Commercial statistics, matters relating to foreign and colonial tariffs, excise and "consumption" duties; port, harbor, and tonnage dues, and other charges on shipping; customs regulations, consular fees, forms of certificates of origin, regulations concerning commercial travelers, trading licenses, foreign and colonial contracts open to tender, foreign and colonial bounties, lists of firms engaged in particular lines of business in different localities, etc. An inquiry room, at which

copies of official publications, directories, and other works of reference may be consulted, is reserved at the offices of the branch for the convenience of personal applicants.

JAMES BOYLE,
Consul.

Liverpool, January 5, 1900.
—Am. Consular Reports.

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THE CUBAN SUGAR INDUSTRY.

From American sources we learn that the industrial position in Cuba is the reverse of promising. The total sugar production this year of Cuba and Porto Rico combined, is estimated not to exceed 300,000 tons, compared with an output of a million tons which used to be raised before the war in Cuba alone. In some localities in the latter islands the yield will be little more than a third of the average year. The shortage in the crop will naturally give volume to the cry of the Cuban planters for protection in the United States. The pressure of overdue mortgages on the sugar properties is now so heavy that a common scheme for their liquidation has been under consideration; but in any event is is felt certain that some of the estates will have to "go under," while the remainder will take years to clear themselves of the incubus which now paralyzes all initiative and improvement. But perhaps the most formidable of all difficulties before the Cuban planters is the question of a labor supply. At present a constant stream of Jamaican negroes is passing into the island through Santiago; but the planting community regard this channel of supply as undesirable, and urge that the immigration law should be amended to arrest the flow. They suggest, also, that a common fund, to which a certain amount might be appropriated yearly, for the purpose of paying the passage to Cuba of "some white families desirous of settling in the country." Those acquainted with the last sixty years' industrial history of British Guiana can prophesy with some confidence that the planters of Cuba, should they attempt to carry out their plans, will sustain keen disappointment. It will never be practicable to secure a reliable laboring population for the sugar estates in the manner now proposed. The United States is opposed to the contract system of immigrant labor as we find it in this colony and Trinidad; and, as the Government of Mr. McKinley has succeeded in putting a period to the importation of Chinese and Japanese into Hawaii, it will never lend its countenance to the introduction of a similar system in Cuba. As was lately pointed out in the columns of an American magazine, a labor supply of indentured immigrants leads eventually to the extinguishment of native labor in connection with the industry concerned, and the American Government will be inclined to regard the position from the standpoint of the masses of the population in whose interests they are pledged to administer

the island. How the sugar planters will fare in these circumstances it is difficult to say, but we anticipate that in a few years the labor problem in Cuba will have assumed a serious aspect—as grave, perhaps, as the planters of British Guiana found it back in the early 'forties, before the inexhaustible reservoir of India came to be tapped for a constant supply. Meantime it is instructive to note that the present Secretary of Agriculture in Cuba, General Rius Rivero, recommends American capitalists to invest their funds in the cultivation of other products than sugar—tobacco, fruits, or cattle breeding, for instance—owing to "the sharp competition from other countries and the facility with which cane fields can be burnt by bandits or revolutionists."—Demerara Chronicle.

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THE WILSON FILTER PRESS.

Letters Patent have recently been granted in several countries for the above improved filter, or filter-press, which constitutes a marked advance upon those at present in use. The inventor, Mr. John Wilson, has studied the question of filtration in Great Britain and the Colonies for many years, and of late has devoted his attention exclusively to the perfecting of the apparatus which bears his name. The introduction of cake filter-presses some years ago supplied a want that had been long felt in many industries, and their universal adoption in the manufacture of sugar, for pressing the lime precipitate and discharging it in a convenient form, testifies to their usefulness in this important branch of industry.

After all, however, they fail to perform much that was expected of them on their introduction. They only become of practical use after a careful and tedious subsidence, or decantation, of the defected cane juice, and to utilize them for the filtration of the opaque decanted liquid involves a considerable waste of time, labor, material, and of saccharose. The other filters, such as "bag" and "gravity" filters, suffer from much the same defects, defects which assume a serious aspect in tropical countries. * * *

This type of filter will particularly interest all those who have to deal with the filtration of cane juice or syrups in hot climates. It may be kept running quickly or slowly, almost at will, because the rapidity with which the cleaning of the cloths can be effected means that, even with a small area, no accumulation of liquor need take place. In fact, where three or four such filters are in use, by cleaning them regularly in succession, a continuous run will in consequence be secured, keeping pace with the crushing work of the mills. The cleanliness of the apparatus will appeal also to those acquainted with the working of other filters. There is no opportunity for sourness to be engendered, and the brushings of the cloths can be at once conducted by pipes away from the buildings. There are many other points connected with this filter which will strike

practical men as of advantage in comparison with other types, but sufficient have been pointed out in these columns for such readers.

As has been observed, the filter has so far been tested with syrup, but whether, in plantation work, it is more advisable to filter the syrup or the decanted juice is a matter of individual opinion. The filtration of the juice before subsidence could also be effected, and the work of the filter-presses thereby facilitated, but enough has been laid before our readers to bring to their notice the merits of this new apparatus. More complete and specific information will be readily granted on application to the manufacturers, The Wilson Filter Syndicate, Limited, Fyfe Chambers, 105 West George street, Glasgow, or to the Inventor at the same address.—Int. Sugar Journal.

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RELATIVE COST OF PRODUCING CANE AND BEET SUGAR.

A very interesting statistical compilation has been made for the Beet Sugar Gazette by Mr. Paul Doerstling, superintendent of the beet sugar factory at La Grande, Ore. The result of his research is given below. It shows the relative cost of producing cane and beet sugar in the various countries and will come as a revelation to many who adhere to the idea generally held that cane sugar is produced much cheaper than beet sugar. While this is true in the cases of several especially favored countries, like Java, Cuba, Porto Rico and Hawaii, the general average cost of producing sugar from cane is shown to be higher than that produced from beets. This is due, of course, principally to the employment of better machinery in the beet sugar industry and the resulting higher output of sugar from a given quantity of raw material. Thus, while it takes twenty tons of cane to produce 1.75 tons of sugar, ten tons of beets make 1.07 tons of sugar.

Mr. Doerstling's compilation is the result of a great deal of patient and painstaking labor and the high standing of the author will give it an additional value as a reliable statistical study:

I.—CANE SUGAR.

	Tons cane per acre	Tons sugar per acre	Cost of sugar per ton
Spain.	17	0.9	$55
Japan.	15.5	1.3	78
Java.	32	3.0	38
Straits Settlements	20	1.6	41
Egypt	19	1.9	45

	Tons beets per acre	Tons sugar per acre	Cost of sugar per ton
Reunion	21	1.9	69
Louisiana	22	1.9	75
Cuba	24	1.8	40
East Indies	—	1.0	36
Hawaii	22	2.8	39
Argentine	13	1.0	62
British West Indies	—	1.7	47
Queensland	—	2.0	28
Porto Rico	20	2.0	28
General average	20	1.75	$62

II.—BEET SUGAR.

	Tons beets per acre	Tons sugar per acre	Cost of sugar per ton
Germany	12.5	1.2	$49
Austria	9.3	1.1	47
France	10.9	1.2	58
Russia	7.2	1.8	60
General average	10.0	1.07	$53.5

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THE UTILIZATION OF SEWAGE.

The improvement of agriculture, through the aid of sewage is, of course, by no means a new question; but it is of particular interest to us at the present time, when Colombo is considering a scheme for the disposal of its sewage, and the ratepayer is threatened with a burden which may prove intolerable. Nor does the fact that the Nagpur Experimental Farm lies within British territory, on the adjacent continent, lessen our interest in its experiences. On the contrary it should stimulate the desire of our municipal authorities to make enquiries with a view to ascertain how far those experiences can be reproduced here. The matter is one affecting both sanitation and finance, with an important bearing on agriculture, which, too, has lately demanded special attention locally. The Friend of India writes:

Progress in the difficult task of elucidating the complex ways Indian agriculture continues to be slowly made at the Nagpur Experimental Farm. The report for last year shows that a complication has been introduced by what seems to be some insidious form of plant disease which affects alike wheat, tur, and linseed. The experiments have been persevered with steadily, however, and in more than one direction encouraging results have been obtained, notably in the success which has at-

tended the application of fresh sewage manure, on the plan devised by Lieutenant Meagher of Allahabad. The Commissioner of Settlements state that the yield of juar which this method gave last season on the farm was phenomenal—nearly three thousand pounds of grain to the acre; while bumper cotton crops were picked on fields that had been thus treated. He thinks that, if extended to all municipal areas, it should enable large crops to be grown in their vicinity and give municipal committees some income from the disposal of sewage. The same experiment, it seems, had been tried with success at Deoli, in Wardha, and steps are now to be taken, through the Central Provinces Government, to try it elsewhere also. The system is described as simplicity itself, the sewage being merely deposited in very shallow furrows and covered up lightly with earth. Another successful experiment made last year was that of treating juar seed with cupric sulphate before sowing, as a preventive against smut. Valuable results were also obtained with an improved varied of wheat which is being introduced through the agency of the farm. Special attention, we learn, is now to be directed to the last-mentioned branch of the operations, the introduction of varieties superior to those already in the hands of the cultivator being one of the most promising of the means of utility open to an institution like the Nagpur Farm. The report does not say much about experiments in the direction of the selection of seed. Such extraordinary results, however, have been obtained in Europe by this means, in the case of all sorts and descriptions of agricultural plants, that it will be of the greatest interest to see it taken up more widely.—Ceylon paper.

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Electrical science has now reached a point when we can begin to consider as a practicable proposition the conservation and distribution of the tremendous force generated by the falling waters of the Sierra. It should be carried to the farms and be made to saw wood, churn milk, pump water, grind grain, fill silos, chop feed, run sewing machines, cut sausage meat, and be handy generally. It has been idle for centuries enough.

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In France, the recent tremendous rise in coal makes a difference in the cost prices of sugars of 6d per cwt. to an average factory, and although, of course, the factories have already contracted for this season's supplies, the effect will be felt in the prices for the following campaign, or in the sowings, in case fabricants try to make the farmers bear the brunt of the increased cost of production, by bidding less for the roots.

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Truck Gardening Pays.—A colored man residing at Crystal Springs, Miss., sold $225 worth of tomatoes from one acre of rented land, and after the tomatoes were gathered made $25 worth of corn off the same acre of land. This was done last

year and is reliable information. It only goes to show the profits of truck gardening.—Ex.

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A writer in Deutsche Zucker Industrie suggests that England will probably impose an import duty on sugar to help defray the expenses of the Boer war, and thereby promote beet sugar manufacturing at home. He thinks Ireland would be a favorable country for beet sugar with its "low, flat land and cheap labor."

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The sugar beet company at Grand Junction, Colorado, is so distressed over some of the results of beet raising the past season that it now proposes to start in and import German beet farmers. They have found that the native westerner is not a natural beet grower and the plan is now hatched to send a special ambassador to Oldenburg, Germany, to induce a colony of 100 or more families skilled in beetology to come over and cast their fortunes in Mesa county in order that the sugar mill may be kept grinding during its prescribed period of operation. A Quaker colony in Bucks county, Pennsylvania, will also be asked to come out and grow up with the beets. The beet tonnage this year ranged all the way from zero up to fifteen tons to the acre. Many of the farmers undertook too large an acreage and failed to devote proper attention to the cultivation of the beets. Ten acres is as large an area as any one man can successfully look after in the Grand valley. The company will pay $4.25 a ton next year for the beets, the same price as was paid this year. They will pay part of the freight charges in cases where the farm is many miles from the factory and in every way possible assist and encourage the farmer.—Colorado paper.

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Louisiana Rice Shipped to Hawaii.—Since the bubonic plague broke out in Honolulu, 28,000 sacks have been shipped via San Francisco to the Hawaiian Islands. Thus a new field has been opened for one of our most important products.

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The quantity of sugar in beet ran originally from five per cent. to seven per cent. Man, by his intelligence, ingenuity and enterprise, has made it to reach in some cases as high as 21 per cent. or even more, that is to say, he has at least doubled it. There must, of course, be a limit to what man can accomplished in the improving of plants, but we do not think the limit has been reached with cane, and if an equal amount of intelligence, ingenuity and enterprise, as the growers of beet have applied, were brought to bear on the still further increasing of saccharine matter in sugar cane, the returns from the sugar cane estates might be very largely increased with no increase of acreage or field labor.